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SOVIET MILITARY RESEARCH AND DEVELOPMENT

THE PROBLEM

To assess the scope and nature of Soviet military research and development (R&D), to estimate the types of weapon and space systems likely to emerge from that effort in the next few years, and to discuss factors that will affect the course of Soviet military R&D over the longer term.

CONCLUSIONS

A. Military research and development (R&D) has been and will continue to be one of the highest priority undertakings in the USSR. The Soviets regard such an effort as imperative in order to prevent the US from gaining a technological advantage, to gain, if possible, some advantage for themselves, and to strengthen the technological base of Soviet power. Most Soviet military R&D is directed toward the qualitative improvement of existing kinds of weapon systems, but we believe that much is also devoted to the investigation of a broad range of new and advanced technologies having potential military applications.

B. With the rapid technological advance of the postwar era, there has been a great expansion in the funds, personnel, and facilities devoted to military R&D and the space program. We estimate that between 1950 and 1966 expenditures for these purposes increased tenfold. It is impossible to make a precise comparison of US and Soviet expenditures; our analysis suggests that if Soviet military R&D and space programs at their present levels were purchased in the US, they would generate an approximate annual expenditure more than three-fourths the amount of US outlays for the same purposes. And the Soviet effort rests on a considerably smaller economic base.

C. Soviet advanced research in fields applicable to military developments is probably now about equal to that of the West. Despite excellent theoretical work, however, Soviet military hardware frequently has not reflected the most advanced state-of-the-art in the USSR. In large part, this can be attributed to a conservative design philosophy which emphasizes proven technology and favors rugged, relatively simple equipment. In part, however, this Soviet choice may have been forced by deficiencies in manufacturing and fabrication techniques. Soviet production technology generally lags behind that of the US, although the Soviets are taking steps to correct these deficiencies.

D. It is almost certain that the Soviets have some type of R&D underway in every important field of military technology. Stringent Soviet security practices normally prevent us from detecting military R&D at the laboratory or drawing board stage. We can, however, detect major weapon systems during testing or early deployment. On the basis of evidence of development activity, our judgment of Soviet requirements, and other considerations, we can make estimates concerning the next generation of major Soviet weapon systems. We cannot estimate, however, the specific weapons which the Soviets will develop for introduction in the longer term, 10 or more years from now.

E. Soviet expenditures for R&D are continuing to grow, but the trend is showing a declining rate of growth, probably because the most costly stages of expansion have been finished. With the higher base level thus achieved, a slower growth rate still implies substantial annual increments. We estimate that total R&D expenditures—for military and civilian R&D and the space program together—will increase by about 7 or 8 percent annually through 1970. If, as we estimate, the Soviet space effort is leveling off, even this moderate growth rate would permit an increase in allocations to civilian R&D and continuation of a strong military R&D effort.

F. The Soviets will continue to press their search for new technologies and systems that offer the prospect of improving their strategic situation. We see no areas at present where Soviet technology is significantly ahead of that of the US. Considering the size and quality of the Soviet R&D effort, however, it is possible that the USSR could move ahead of the US in some particular field of strategic importance. The Soviet leaders would certainly seek to exploit any

significant technological advance for political and military advantage, but in deciding to deploy any new weapon system they would have to weigh the prospective gain against the economic costs and the capabilities of the US to counter it.

DISCUSSION

I. GENERAL FEATURES OF SOVIET MILITARY RESEARCH AND DEVELOPMENT

Priority of Military Research and Development

1. Military research and development (R&D) has been and will continue to be one of the highest priority undertakings in the Soviet Union. The Soviets regard such an effort as imperative in order to prevent the US from gaining a technological advantage and also to gain, if possible, advantage for themselves. Most Soviet military R&D is directed toward the qualitative improvement of existing kinds of weapon systems, but we believe that much is also devoted to the investigation of a broad range of new and advanced technologies having potential military applications.

2. In addition to military considerations, scientific achievement has become for the Soviets a measure and symbol of the strength and progress of socialism. Advanced military and space developments are a way of demonstrating that the USSR has permanently emerged from its early decades of backwardness and is now in the first rank of technologically advanced societies. Moreover, the significant psychological impact of early missile and space successes has almost certainly led the Soviets to emphasize missiles in military displays and to seek further space spectaculars.

The Growth of Soviet Military R&D

3. With the rapid technological advance of the postwar era there was a great expansion in the Soviet R&D effort. This was reflected first of all in the increase of establishments and facilities—scientific research institutes, observatories and laboratories, installations for design testing, and numerous major facilities up to the great complexes at Kapustin Yar, Tyuratam, and Sary Shagan. In general, any scientific program that in the view of Soviet leaders has important military application is given adequate and in some instances lavish R&D facilities. The result is apparent in the vigorous Soviet space program and in the successive generations of new weapons deployed in the field.

4. The most convenient measure of this expansion is in terms of costs or expenditures for resources. We estimate with fair confidence that total R&D expenditures—that is, outlays for civilian and military R&D and the space program taken all together—rose from about 1 billion rubles in 1950 to almost 7 billion in 1966. Within this total the breakdown is less clear. Military R&D and the space program have between them taken the lion's share, rising from an estimated ½ billion rubles to more than 5 billion during the same period—a tenfold increase. As between military R&D and the space program we can only say that both are large, and that since the early 1960's

the greater part of the increase can probably be attributed to the rising cost of the space program, which in itself includes some military projects.

5. In the R&D field, the calculation of ruble-dollar ratios is particularly uncertain, and comparisons between the Soviet and the US efforts can be only roughly approximated. In terms of total R&D expenditures (civilian, military, and space), the USSR appears to lag behind the US; we estimate total Soviet expenditures at something over two-thirds the US level. Most of this difference, however, is attributable to the larger US civilian programs. Our analysis suggests that if the inputs (i.e., wages, materials, and overhead) for all Soviet military R&D and space programs were purchased in the US, they would generate an approximate annual expenditure in excess of three-fourths of current US outlays for the same purposes.[1] And the Soviet effort rests on an economic base considerably smaller than that of the US.

6. Trends in expenditures for military R&D and space in the USSR have roughly paralleled those in the US. In both countries these activities have received steadily increasing shares of available resources. In 1955, they accounted for about 6 percent of total Soviet military and space expenditures, and in 1965 some 25 percent; comparable figures for the US show a rise from 8 to 28 percent. In recent years, however, the *rate* of growth of expenditures on military R&D and space has declined in both countries, presumably because the building of new facilities and creation of new organizations have passed through their most costly stages. A much higher base has been achieved, and the lower current rates of growth still add very substantial increments each year to total expenditures.

7. *Manpower.* One of the most important means used by the Soviet Government to improve and broaden its scientific and technological base has been the national system of higher education, which for many years has emphasized scientific and technical fields, particularly the physical sciences, mathematics, and engineering. The number of graduates in these fields has steadily increased, particularly in the postwar period. The USSR, with some 1.5 million engineers and over 100,000 holders of advanced degrees, now has a larger pool of scientific and technical manpower than the US, and there will be a continuing increase in scientific and technical graduates in the next 10 to 15 years. Many of these people, however, are employed in administrative or other duties outside the lines of their specialized training.

8. The Soviets have also sought to improve the quality of their higher education, and most of the advanced degrees currently being awarded in scientific and technical fields are roughly comparable to American Ph.D.'s. In certain fields, however, such as the biological and chemical sciences, they are still below US standards. Moreover, a large number of advanced degrees awarded in the past represent academic achievement inferior to present Soviet standards.

[1] For the US, these include the total budget of NASA and the R&D budgets of Department of Defense and Atomic Energy Commission.

Thus, the USSR may have fewer really qualified persons capable of significant, independent research at this level than the US.

9. We can make no meaningful estimate of the number of people working on military R&D projects in the USSR, but it is clear that the supply of scientific and technical manpower imposes no constraints on priority military R&D programs. Soviet statistics indicate that the number of scientific workers in all types of scientific research organizations has more than doubled since 1957, and the proportion working on military R&D and space has probably grown even more rapidly. Indeed, there are indications that the R&D effort in support of civilian production activities has suffered because the best people are attracted to military R&D, the space program, and certain key institutes.

Quality of Soviet R&D

10. We have no firm basis for judging whether or not the military R&D effort is managed with significantly greater efficiency than other important sectors of the Soviet economy. Frequent administrative reorganizations indicate some dissatisfaction on the part of Soviet leaders with their scientific effort. One of the complaints in the USSR has been that the high quality of theoretical work in the USSR has not been matched by the technology of product development. The top leadership has always exhibited a close and continuing interest in military R&D programs, and is clearly concerned with improving the quality of the entire effort.

11. Soviet theoretical work in fields applicable to military R&D is probably now about equal to that of the West. There are a few areas, such as pure mathematics, where the Soviets may be slightly ahead of comparable Western research. There are other fields, such as areas of chemistry relevant to solid propellant technology, where they are apparently behind the US. In general, however, they are probably capable of conducting advanced research at a level comparable to the West in any field to which they decide to devote the necessary time and resources, but they may not be able to conduct advanced research in as many fields simultaneously as in the US.

12. Despite their excellent theoretical work, there have been many cases in the past in which the Soviets have not produced military hardware which fully reflected the most advanced state-of-the-art in the USSR. In large part, this was almost certainly a deliberate choice. The Soviets have had a conservative design philosophy; they have preferred to carry through the development of weapons with well-proven technology, thus minimizing the chances of delays and difficulties. On the whole they have favored equipment and hardware of rugged and relatively simple design, comparatively easy to maintain.

13. In part, however, this Soviet choice may have been forced by deficiencies in manufacturing and fabrication techniques. The general level of Soviet production technology still lags behind that of the US, and this factor may have

restricted the variety of weapons of very advanced design which could feasibly be produced in quantity. In recent years, however, the Soviets have taken steps to correct these deficiencies, and in some special fields of manufacturing methods they have advanced their techniques beyond those in the US.

14. An extremely important asset of Soviet military R&D is the large amount of information which the USSR obtains on US and other Western R&D efforts. Information about Western programs is clearly of value to the Soviets in overcoming technical problems and avoiding unprofitable avenues of research. Moreover, it helps Soviet planners to direct and time their military R&D effort in the light of anticipated Western capabilities.

II. US KNOWLEDGE OF SOVIET MILITARY RESEARCH AND DEVELOPMENT PROJECTS

Nature and Quality of the Evidence

15. The early phases of an R&D program are to a large extent invulnerable to technical collection systems and Soviet security has succeeded in preventing US intelligence from gathering any more than limited, nonspecific information.

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16. The problem changes once the testing phase is reached. Even in this phase, however, the amount of information which we can obtain about a Soviet weapon system varies with its vulnerability to our technical collection systems. We can usually obtain data on the characteristics of those major systems and in some cases from those major systems we can usually identify new aircraft in the prototype stage. Large systems such as ICBMs and ABMs require extensive facilities which can usually be detected and sometimes identified before testing begins.

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17. Soviet military displays are source of information on new weapons of certain types. These displays, of course, are matters of Soviet discretion and policy. In recent years the Soviets, in order to project their image as a military power, have displayed a number of advanced weapons which were either in service or in late stages of development. But they have withheld some major weapons from display, and some of the weapons

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displayed have been prototypes which never reached the production stage (e.g., the Bounder bomber). Indeed, the Soviets may have attempted to mislead us on occasion, by displaying prototypes or mockups which they never intended to deploy.

18. [redacted]

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19. [redacted] we must base many of our estimates of future weapons on indirect evidence and analysis. By analyzing the life cycle of previous systems and known or estimated deficiencies in their present systems we often estimate that the Soviets require and will probably develop a new weapon. Analysis of the state-of-the-art and of the preferred Soviet technological approach is often of assistance, as is analogy with US experience. It should be noted, however, that these indirect methods can do no more than indicate what R&D we believe the Soviets should be pursuing in order to remedy weaknesses in existing weapon systems or to develop new ones. They do not enable us to determine in the pretesting phase whether the USSR is in fact pursuing such R&D or how successful Soviet efforts to date have been. More knowledge of the early phases of Soviet R&D could serve to narrow the spectrum of potential weapon systems. We would still have to consider other factors, however, such as production capabilities, costs, and military objectives, in estimating which systems the USSR would be likely to develop to the point where they could be deployed.

Intelligence Lead-Time on Soviet Weapon Systems

20. For purposes of this discussion, we define intelligence lead-time as the period between the time when intelligence identifies the general nature and purpose of a new weapon system and the time of its initial operational capability (IOC). What constitutes useful intelligence lead-time will depend to a considerable extent on the problems facing the user of the intelligence—for example, an intelligence finding that the Soviets are intensively developing ABM systems might be sufficient for a US decision to initiate R&D studies on ICBM penetration aids, whereas a decision as to which penetration aids to develop might require detailed intelligence on the specific characteristics of Soviet ABM systems.

21. Information permitting an analysis of system characteristics is usually accumulated gradually during the course of the system's testing and deployment. In some cases, we can estimate a system's characteristics with high confidence soon after initial identification, while in others it may take years to gain an appreciation of how a system functions. Intelligence lead-time will also be affected by how long the Soviets take to develop the system in question, and this in turn depends on the complexity of the problems involved and how urgently and efficiently the Soviets seek to solve them.

22. [redacted] In most cases, we have been able to determine the basic characteristics of a new strategic ballistic missile system during its flight test phase, [redacted] This lead-time will probably remain substantially unchanged, but may vary [redacted] depending upon the complexity of the system. [redacted]

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23. Defensive missile systems present even more difficult problems of lead-time than do ICBMs. We have generally been able to detect such systems well in advance of IOC, but we have not always been able to determine a system's characteristics before it became operational. We have been aware, for example, of Soviet efforts to develop ABM defenses for at least seven or eight years, and in 1963 we detected the beginning deployment of an ABM system at Moscow. We have estimated that this system will become operational in 1967 or 1968, but we still cannot give a confident estimate of its capabilities. We also detected deployment of the Tallinn defensive missile system when it began in 1964. This system is probably now operational, but we still have little knowledge of its characteristics.

24. Very large radars associated with defensive missile systems generally require two or more years to build and check out, and we will usually be able to give one or more years' advance notice of new systems of this type. However, the electronic characteristics of most radar systems have not become known to us until the late stages of R&D or until after IOC.

25. In recent years, we have in most cases identified Soviet combat aircraft some three to four years prior to their operational deployment. Future aircraft will probably be even more complex and require more testing than current models. It is unlikely, therefore, that intelligence lead-times will be significantly shorter.

26. In most cases, major surface ships can be detected and identified one or more years prior to IOC and useful intelligence on the type of weapons and electronics being installed can sometimes be obtained. Submarines, which are

built on covered ways, are not normally detected or identified as to type until they have been launched and are being fitted out, which takes about 6-12 months.

27. With the exception of certain missiles, there is usually little if any intelligence lead-time for ground force weapons and naval ordnance. In many instances, our first indication of the development of new ground force weapon systems is their utilization in field training.

28. The provision of sufficient lead-time will continue to be a major problem for US intelligence.

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It is highly unlikely that major strategic weapons such as ICBM and ABM systems could be developed without extensive activities of a kind which would be vulnerable to our technical intelligence collections systems, but these activities might not provide the necessary information about performance characteristics. Moreover, significant improvements in existing weapon systems could occur which would go undetected or not be correctly identified.

III. MAJOR SYSTEMS UNDER DEVELOPMENT

29. It is almost certain that the Soviets have some type of R&D underway in every important field of military technology. These programs range from basic research, through applied research with military application, to the development of specific weapon systems. The USSR, like any other highly developed nation, undoubtedly investigates a great many concepts applicable to advanced weapons which never leave the drawing board or laboratory. Their long-range programs are almost certainly subject to change from time to time in the light of their estimate of US plans and intentions. Moreover, of the Soviet projects in various stages of R&D, some will be abandoned because they will prove infeasible, not worth the cost, or not applicable to requirements.

30. This section discusses those weapon and space systems which we believe are currently undergoing R&D in the Soviet Union.[2] These are major systems for which we feel there is either sufficient evidence of R&D activity or a clear Soviet requirement on which to base a reasonable estimate. We cannot estimate with any degree of confidence the specific weapon and space systems which might conceivably arise out of the various fields of scientific effort which Soviet scientists, like others, are pursuing. We have found no way of estimating which

[2] These estimates of systems under development are drawn from the following: NIE 11-1-67, "The Soviet Space Program," dated 2 March 1967, TOP SECRET; forthcoming NIE 11-2-67, "The Soviet Atomic Energy Program," TOP SECRET,

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NIE 11-3-66, "Soviet Strategic Air and Missile Defenses," dated 17 November 1966, TOP SECRET; NIE 11-8-66, "Soviet Capabilities for Strategic Attack," dated 20 October 1966, TOP SECRET, and NIE 11-14-66, "Capabilities of Soviet General Purpose Forces," dated 3 November 1966, SECRET.

fields of research will in fact lead to weapons application, what progress the Soviets may make in them, or which successes in research they may choose to push on into weapons development and deployment.

A. Strategic Weapon Systems

ICBMs and Space Weapons

31. The Soviet Union appears to be about as technically capable as the US of developing new ICBM systems and subsystems which its leaders feel are important enough to justify the expenditure of resources. Most of the facilities at the Tyuratam test range can be associated with existing ICBM systems or with the space program. Some of those recently completed or under construction are probably associated with ICBM systems still under development. Testing of some new missiles appears likely during the next year or so.

32. Current R&D activities provide clues as to the types of follow-on systems that the Soviets might deploy in the late 1960's and early 1970's. During the past year they have been conducting tests that we believe relate to the development of a fractional orbit bombardment system (FOBS), a depressed trajectory ICBM (DICBM), or both. A FOBS or a DICBM could serve to degrade the value of US antimissile detection systems and complicate the US problem of developing effective ABM defenses. These tests could also relate to the development of a multiple orbit bombardment system, but we believe it unlikely that the Soviets will deploy such a system in space.

33. Soviet interests in solid-propellant missiles and mobile systems suggest other possible trends in ICBM development. We have estimated that the Soviets will develop and deploy in the 1968-1972 period a small, more accurate, solid or storable liquid propellant ICBM in a hard and possibly in a mobile configuration. The liquid propellant system deployed in fixed sites would be more likely to appear in the early part of the period; solid or mobile systems could be achieved somewhat later. Mobile deployment would greatly decrease vulnerability, especially if it featured concealment or random movement. It is possible that they will also develop a new large liquid propellant ICBM with high accuracy for deployment in the 1970-1972 period. Such a system would have improved capabilities against hardened targets.

34. There is no evidence that the Soviets have initiated development of MRVs, MIRV, or penetration aids. A relatively simple MRV delivery capability could probably be achieved within 12 months after the start of flight testing. Development of MIRVs involves greater complications than MRVs, particularly in guidance and control; operational capabilities could probably be achieved two to three years after flight testing began.

MRBM/IRBM

35. The Soviets are currently conducting a flight test program which suggests that a solid propellant MRBM/IRBM system is under development. This sys-

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tem, [redacted] has been fired to 1,050 n.m. from Kapustin Yar and to 3,100 n.m. from Plesetsk. [redacted] could achieve IOC in late 1967 in either a fixed or mobile configuration, however the slow [redacted] flight test program suggests that IOC will probably be somewhat later.

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36. The Soviets are also testing a new liquid-propellant ballistic missile, [redacted] This missile is being flight tested from Kapustin Yar and has been fired to the 1,050 n.m. impact area. It is still too early to define the characteristics of this system; however, our evidence indicates a high accuracy potential.

Missile Submarines

37. We believe that a new class of ballistic missile submarine is under construction; it will almost certainly be nuclear-powered and may carry eight or more missiles. Such a new weapon system would probably employ a new solid or improved liquid-propellant missile having a range of some 1,000-2,000 n.m. Some recent test-firing activity at Kapustin Yar may be related to such a missile, but it is also possible that an appropriate missile has not yet been test fired. In any case, we believe that a new nuclear-powered ballistic missile submarine equipped with a 1,000-2,000 n.m. missile could become operational by mid-1968. The Soviets will probably not undertake the development of a new class of cruise missile submarine in the next 10 years. They may, however, develop a new type of cruise missile with increased range, speed, and accuracy.

Long-Range Aircraft and ASM's

38. There is no evidence of any specific development program directed toward a follow-on heavy bomber. Available evidence indicates that Soviet work in large aircraft is directed primarily toward the development of new transports. This work advances the state-of-the-art and provides a technological and production base which could be applied to bomber development. If the USSR has without our knowledge actively pursued R&D and committed funds for production and deployment, a new subsonic heavy bomber with capabilities slightly better than the Bear could enter service by 1970. We believe that we would obtain indications of the development and production of such an aircraft one to three years prior to its introduction into operational units.

39. The requirement which led to the Blinder, together with the troubles experienced with that aircraft, may lead the Soviets to develop a follow-on medium bomber. The Soviets could develop a supersonic-dash medium bomber with better speed, altitude, and radius than the Blinder for deployment in the 1972-1975 time period. Alternatively, as a concurrent development with their supersonic transport program, they could develop a supersonic cruise medium bomber, with a radius about the same as Blinder's, in the same time period.

40. Development work on land attack and antiship ASM's continued during the past year. There is some evidence that the Soviets are working to improve the

guidance of the AS-3 and it is possible that they will develop a follow-on ASM for use with the Bear. They are continuing the development of the Blinder AS-4 system, and we believe that they are also developing a new ASM for use with the Badger.

B. Strategic Defensive Weapon Systems

Ballistic Missile Defense

41. For the past decade the Soviets have carried on an extensive, varied, and costly R&D program to create defenses against ballistic missiles. They probably have explored various ABM techniques, radars, interceptor missiles, and concepts of system integration. The Soviets will probably devote substantial effort to improving their present ABM capabilities, and also to developing new ABM systems, although we have no evidence that any new system is under development. Improvements may include a high acceleration missile, possessing capabilities for terminal atmospheric intercept, and a new long-range missile. We would not expect such new systems to become operational before the early 1970's.

Air Defense Systems

42. *Radars.* The Soviets will probably continue to introduce improved radars with increased power and greater sophistication. These new radars may include frequency diversification to reduce mutual interference problems and vulnerability to ECM. A considerable effort will probably be expended on the problem of detecting and tracking low-altitude targets.

43. *Interceptors.* The Soviets are continuing R&D on advanced interceptor aircraft. We believe that the present R&D activity is directed toward development of aircraft with a maximum speed on the order of Mach 2.8-3.0, an altitude capability of 70,000-75,000 feet, and a combat radius of about 500 n.m. Such aircraft could enter service in the period 1968-1970. The Soviets probably see the need for even more advanced interceptor systems for use in the 1970's and may already be testing such models. An advanced all-weather interceptor with a Mach 3 cruising speed and a radius of 700-1,000 n.m. could enter service in the 1972-1976 period.

44. *Surface-to-Air Missiles (SAMs).* We know of no wholly new SAM systems under development; R&D activity appears to be directed toward modification of existing systems. The Soviets could improve their systems by developing a better low-altitude acquisition radar, a modified fire-control radar and guidance system, and possible terminal homing. No Soviet SAMs deployed or under development are estimated to have a capability under about 1,000 feet. The Soviets probably cannot significantly improve their present low-altitude capability by modifying existing SAM systems, and they may develop a new low-altitude system. We would not expect any new low-altitude system effective under 1,000 feet to be operational before about 1970.

Antisatellite Systems

45. The large Hen House radars at Sary Shagan and Angarsk will have a coverage pattern indicative of a space surveillance system. A Soviet antisatellite system employing these radars could use an existing missile with a nuclear warhead. Nonnuclear kill, on the other hand, would probably require a ground-guided missile system of high precision or a homing missile capable of exoatmospheric maneuver, either of which could be developed in about two years after a decision to do so.

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[redacted] we believe, therefore, that at about the time the Hen Houses become operational in the 1967-1968 time period, the Soviets could have an antisatellite capability with either nuclear or nonnuclear kill.

C. Weapons for General Purpose Forces

Ground Force Weapons

46. The Soviets will almost certainly continue their R&D efforts in all types of ground force weapons and continue to introduce improved ground force equipment. Major new weapon systems which could enter service in the next five years or so include: (a) a medium tank armed with a missile-firing system; we would not expect such a tank to be deployed until about 1970; (b) an improved version of the Scud tactical ballistic missile system; the Soviets are currently testing a new system at Kapustin Yar which may be the follow-on Scud, and could be operational within the next year or so; (c) a tactical low-altitude SAM system; we would not expect any new low-altitude system effective under 1,000 feet to be operational before about 1970.

Tactical Aircraft

47. We believe that the Soviets are working on an improved tactical fighter as a follow-on to the Fishbed/Fitter series. Such a fighter could become operational in the 1968-1969 time period. In addition, the Soviets are probably working on various designs for advanced tactical fighters, including V/STOL types, which could attain IOC after 1971.

Naval Systems

48. We believe that the Soviets are developing a new class of nuclear-powered, torpedo-attack submarine, probably designed and equipped for ASW operations; it could enter service as early as 1968. The only new classes of major surface ships currently under construction in the USSR are the Kresta-class large frigate and a new class of probable helicopter carriers. The Kresta-class is equipped with surface-to-surface missiles and SAMs, and is fitted with helicopter facilities. The Soviets are continuing R&D on surface ship designs, but we believe that another new class of major surface ships will not emerge before the mid-1970's.

49. The USSR almost certainly will endeavor to improve its ASW capabilities by the development of improved sonar and more effective weapons for surface ships, submarines, and aircraft. We believe that the Soviets will continue to deploy new and improved ASW detection equipment and weapon systems. Present Soviet fixed underwater surveillance systems have very limited range and detection capability, and are intended for inshore defense. There is tenuous evidence, however, that they are attempting to develop a new longer range system. A very great improvement in the quality of Soviet naval forces, together with a significant expansion in size, would have to take place in order for the Soviets to be able to conduct effective ASW operations in open ocean areas. There is no evidence that such an expansion is impending or planned.

50. *Naval Aircraft.* A new type of ASW helicopter and a patrol plane probably will be developed by 1971. A new supersonic-dash jet medium bomber might be introduced in the 1972-1975 period as a follow-on to the Badger and Blinder bombers, but there is no evidence that such an aircraft is under development.

D. Nuclear Weapons

51. Since the signing of the Partial Test Ban Treaty four years ago, the Soviets have continued underground testing of nuclear weapons at the rate of about one test per month. The number of tests and associated yields suggest that the Soviets could have made advances in weapons ranging in yields from a few kilotons up to a few megatons. It is possible that they could have developed a variety of weapons in the low megaton and submegaton range with a significantly better yield-to-weight ratio than those weapons tested in the 1961-1962 series. However, in the absence of debris from underground tests which would permit weapon analysis, we cannot determine what specific progress the Soviets have made.

52. In addition to their current ABM warhead capability, we believe there is about an even chance that the Soviets have developed an ABM warhead with a larger exoatmospheric kill radius against unshielded RVs. If the Soviets have not already developed such a weapon, we believe they could do so on the basis of existing technology without violating the Partial Test Ban Treaty.

E. Space Systems

Launch Vehicles

53. The Soviets currently have under development two large boosters which we believe will be used solely for launching space vehicles. The first of these, which we designate the SL-9, has an estimated first-stage thrust of 2.5 to 3 million pounds and has demonstrated an earth-orbit payload capability of about 27,000 pounds, and of 50,000-60,000 pounds with the addition of a third stage.

54. There is evidence that the Soviets are building a very large launch facility at Tyuratam which is probably of the same magnitude as the US Apollo launch complex at Merritt Island. We estimate that this facility will be ready for initial launch operations in the first half of 1968 at the earliest. We have no direct evidence on the characteristics of the new very large booster to be launched from this facility, but consider it likely that it will have a first stage thrust in the 7,500,000-15,000,000 pound range.

High Energy Propellants

55. To date, no Soviet flight tests or space launchings have been detected which used high energy propellants in any of the stages. However, we believe some phases of static testing are now being conducted and flight testing could begin in 1968-1969. High energy upper stages for the SL-9 or the new very large booster could be man rated and available for use about 1970 or shortly thereafter. Such upper stages would increase the capability and efficiency of the launch systems available to the Soviets and permit considerable flexibility in planning future space missions.

Other Space Technology

56. Although we have little direct evidence about Soviet plans for future space missions, we believe that the Soviets have underway a manned space flight program of a size comparable to the US Apollo program. While we are unable to determine if the first major goal of the Soviet space program is a manned lunar landing or a large manned space station, either of these projects requires the Soviets to make a considerable technological advance over the manned space systems they have demonstrated thus far. We believe that they will not seek to do both concurrently. If the Soviets plan to accomplish either of these space missions by the early 1970's, they must currently have underway extensive R&D programs in such fields as reentry technology, power supplies, life support systems, and numerous other supporting technologies.

IV. FACTORS AFFECTING SOVIET MILITARY RESEARCH AND DEVELOPMENT POLICIES AND DECISIONS

57. Because of the increasing complexity of advanced weapon systems and the long lead-times required for their development, the Soviet leaders must soon decide upon development of those advanced weapons which could be deployed in the mid-1970's. In the previous section we have considered present trends in R&D, technical capabilities, and military requirements. Beyond these military and technical factors, however, lie a number of other, more general considerations, which the Soviet policymaker must weigh in deciding upon future force levels and structures. The more important of these are discussed below.

A. Domestic Factors

58. *Military Influence on the Government.* The present Soviet leaders seem more responsive than Khrushchev to opinions of the various specialized interest groups, including the military hierarchy, but no single group outside of the party apparatus plays a predominant role in determining Soviet national policy. Nonetheless, the traditional Soviet concern with security and the very size of the military establishment enhance the importance of the high command's influence in top level deliberations on basic decisions. Current military writings reveal a concern with broadening the military options available to the USSR, including improved capabilities to meet contingencies short of general war. At the same time, costly and intensive development of strategic forces is continuing. The military will probably continue to press vigorously for increasing amounts of R&D resources for advanced military technology, and the political leaders have been willing to authorize increases in the resources allocated to military purposes. However, the leadership will not automatically grant everything the military request; they must of necessity balance the military demands with those of other consumers and weigh their decisions in terms of national interest.

59. *Resource Allocation Problems.* The resources needed for R&D are in relatively short supply, and the apparent awareness by the leadership of the demands of the civilian economy has exacerbated the continuing debate over resource allocation. This seemingly intractable problem of allocating resources among the various military and civilian claimants will continue to plague the Soviet leaders, forcing them to make hard decisions between costly alternatives. The lengthy bureaucratic infighting involved in these decisions has undoubtedly been a major contributing factor in delaying the appearance of the new Five-Year Plan.

60. The impact of advanced weapon projects and the space program on the civilian economy is greatest in areas requiring high quality resources—trained manpower, technical equipment, and special materials. The large-scale technological modernization program is a good case in point: like the arms and space programs, it requires advanced production technology, electronic equipment, special metals, and first-class production and managerial skills. The drain of these resources from the civilian sector has undoubtedly retarded the modernization program and contributed to the slowing of the rate of economic growth. Although the military and space programs will continue to command top priority, the leadership will be under strong pressure to balance their claims on resources with those of the civilian programs.

B. Soviet Military Policy, Strategy, and Foreign Policy

61. In general, the overall Soviet military R&D effort is less subject than force levels or deployments to the influences of the international situation, levels of tension and arms control agreements. Long lead-times for complex hardware leave less room for quick changes. Military R&D is not likely to be stepped up in response to an immediate crisis, nor is an easing of tensions likely to pro-

duce a cutback. While Moscow might in some circumstances decide to stretch out or defer procurement, it views continued military R&D as an essential long-term investment.

62. Arms control agreements or other international developments could cause some redirection of R&D efforts. The most simple case would be agreements which prohibited certain types of weapons testing and thus cut off R&D efforts in certain directions at a point in the development cycle. But in the case, for example, of a prohibition against flight testing MIRVs, the Soviets would probably choose to carry out laboratory and design work up to the point of flight testing in order not to be caught short if the agreement failed. More generally, an arms control agreement may focus R&D efforts on certain systems or types of weapons. Indeed, an arms control agreement which limited numbers but not characteristics of strategic weapons systems would be likely to spur efforts to improve characteristics in order to maximize military potential within the limits set by the agreement. In any event, the military leadership would strongly resist any arms control proposal which would restrict the military R&D effort.

63. Over the long run, changes in the political situation and in Moscow's perception of potential threats from different quarters will affect requirements for military R&D. Among purely military considerations, however, the strategic relationship between the USSR and the US will remain the most important. The strategy of deterrence pursued by the Soviets has led to an emphasis on strategic offensive and defensive weapons programs that has dominated the Soviet military R&D effort for a number of years. We believe that the chief concern of the Soviets will continue to be to maintain the credibility of their deterrent. They will continue to strengthen their capabilities for survival and retaliation, and in addition they will probably seek through both offensive and defensive programs to improve their ability to reduce the damage the US can inflict on the USSR. Beyond these general propositions, we cannot judge the effect of these considerations on the scope and direction of Soviet military R&D.[3]

V. OUTLOOK

64. The Soviets will continue to give a high priority to research applicable to advanced military systems. At the same time, however, there is evidence of a current drive within the Soviet Government to increase substantially the R&D effort directed to support of civilian production activities. Delay in promulgating the Five-Year Plan suggests that this as well as other issues are not yet settled. Hence, the relative proportions of resources to be devoted to military and civilian R&D and the space program in 1970 have not yet been fully determined

[3] Col. Harry O. Patteson, for the Assistant Chief of Staff, Intelligence, USAF, believes that the intensity with which the USSR is pursuing a massive military research and development program could portend far more than an intent merely to strengthen Soviet deterrent posture and could well be aimed at attainment of a strategic military position which the US would recognize as providing the USSR with a credible first strike damage limiting capability as well as an assured destruction force.

65. Expenditures for R&D in the USSR are continuing to grow, but the trend is showing a declining rate of growth. We have noted above that this decline is probably explained by the fact that some of the most costly stages of expansion have been finished, and also that with the higher base level thus achieved a slower growth rate still implies substantial annual increments. The budgetary plan for 1967 suggests a continuation in this decline, showing expenditures for science in 1967 as only six percent greater than in 1966 (this compares with an average annual rate of growth of about 13 percent since 1950). It is true, however, that expenditures in the past have usually been substantially above plan.

66. We estimate that total expenditures—for military and civilian R&D and the space program together—will increase by about 7 or 8 percent annually through 1970. The space program will probably require less sizable annual increases over the next few years as current programs peak and the effort levels off. This will permit, even with the moderate growth rate projected, an increase in allocations to civilian R&D and continuation of a strong military R&D effort. We do not see on the horizon of the next few years any new scientific-technological development—like atomic energy, ballistic missiles, or the space program—which would require vast new expenditures for establishing elaborate new research and test facilities on the scale of, say, Tyuratam or Sary Shagan. We believe, therefore, that expenditures on this order will be adequate for Soviet requirements as we foresee them.

67. In spite of a considerably smaller economic and industrial base, the Soviets have demonstrated the ability to carry on a highly effective R&D program. They will continue to improve their existing weapons as well as to press their search for new technologies and systems that offer the prospect of improving their strategic situation. At the present time we do not see any areas where Soviet technology is significantly ahead of that of the US; however, considering the size and quality of the Soviet R&D effort it is possible that they could move ahead of the US in some particular field of strategic importance. On the other hand, there are some areas where the Soviets will see a requirement to develop systems that the US probably would not choose—and vice versa. In some instances, they will probably develop and deploy systems which, in the US view, are not justified. The Soviet leaders would certainly seek to exploit any significant technological advance for political or military advantage, but in deciding to deploy any new weapon system they would have to weigh the prospective gain against the economic costs and the capabilities of the US to counter it.